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NUTRITIONAL EVALUATION OF BISCUITS PREPARED INCORPORATING GREEN BEANS POWDER

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ABSTRACT
Four types of fresh beans powder viz. cluster bean, cowpea bean, French bean and sem bean were used in the preparation of value added biscuits.All the biscuits prepared from fresh beans powder had moisture (0.89 per cent to 1.27 per cent) and fat (24.17 per cent to 25.00 per cent) content similar to that of control biscuits (0.88 per cent and 23.41 per cent, respectively). The protein content (9.10 per cent to 10.35 per cent) of all the supplemented biscuits was significantly higher than the control biscuits (7.58 per cent). The crude fiber and ash contents were maximum in cluster bean biscuits. All the biscuits prepared using beans powder had significantly higher total dietary fiber (13.67 per cent to 14.79 per cent) as compared to control to biscuits (12.02 percent). Sem bean biscuits had significantly higher amount of calcium (58.50mg/100g) than cluster bean, cowpea bean and french bean biscuits (57.26 to 57.78mg/100g). The phosphorus, iron and magnesium content of beans powder supplemented biscuits were significantly higher than control biscuits. The incorporation of fresh beans powder to the biscuits brought about a significant higher in their manganese (1.64 to 1.82 mg/100g) and potassium content (371.04 to 399.29 mg/100g).

INTRODUCTION

In this era of global industrialization and advancement of technology, the life style of the people has changed a lot. In this changing life style the demand for ready to eat foods like baked foods has increased. Nutritional enrichment is current interest because of consumer trends and government guidelines. There is growing awareness among consumers regarding the constituents that affect health both positively and negatively (Pratyush *etal*., 2015). The number of such health conscious customers is fast increasing and new foods with new health claims are flooding the market to meet diverse demands. Consumer today wants to consume foods, which can fit into their globe are working to replace unhealthy ingredients and supplement them with therapeutic value. The green pods are rich source of proteins, minerals and vitamins (Punia *et al*., 2008). Beans are often the main source of protein, and a significant source of minerals for low- income population (Laparra *et al*., 2009).Varieties of phytochemicals, e.g. phenolics, carotenoids and flavonoids, have been shown to possess functional properties such as antimicrobial, antimutagenic and free radical scavenging activity (Lokendrajit *et al*., 2013). The vitamins A and C present in green beans are an excellent antioxidant that reduces the amount of free radicals in the body and prevent the building up of plaque in arteries and veins. Beans have been shown to have increased content of dietary fiber. Soluble dietary fiber plays an important role in lowering serum cholesterol and glucose level, while insoluble dietary fiber is essential in maintaining intestinal health (Grewal, 2007). Beans are good source of micronutrients. Multiple micronutrient deficiencies are very common than single deficiency mainly in developing countries. Nutritional problems are more severe; mostly people in the developed countries also suffer from different forms of these nutritional problems (Krishnaswamy, 2009). Beans, the major constituents of Fabaceae family, are utilized both for fresh green pods as vegetable and dry seeds as pulse (Yamaguchi *et al*., 1997 and Saxena *et al*., 2010). Fresh raw green beans are the major vegetable types that consumers purchases for consumption, while processed vegetables in the dried, frozen and canned forms are also available (Kmiecik *et al*., 2007). Vegetables are also valuable in maintaining alkaline reserve of the body (Kisan *et al*., 2015).There is little attention paid to its nutritive value (Deol and Bains, 2010). Cooking is known to alter sensory attributes and nutritional quality while the consumption of vegetables depends largely on their sensory appeal rather than their nutritional quality (Kala and Prakash, 2006). Baked products have made their space in Indian kitchen since time immemorial. Biscuits are low in cost, can be stored for longer time at room temperature. Biscuits are rich in fat and sugar content but have lower content of dietary fiber, vitamins and minerals (Garg, 2015). Addition of beans powder (rich in protein, dietary fibers,vitamins and mineral); will improve the nutritional profile of the biscuits. The paper deals with study on organoleptic and nutritional properties of beans powder added biscuits.

MATERIALS AND METHODS

Procurement of material

Fresh samples of green beans viz., cluster bean (*Cyamposistetragonaloba*), cowpea bean (*Vignaunguiculata*), french bean (*Phaseolus vulgaris*) and sem bean (*Dolichhos lablab*)were cleaned and washed under tap water to remove dirt and dust.

The washed beans were spread over filter paper to remove excess water. All washed beans were chopped and dried in hot air oven at 60 ± 5 °C for 78 h. The dried beans were ground in an electric grinder (Cyclotec M/s Tecator, (Hoganas, Sweden) to fine powder. The dried powders were kept in air tight containers at room temperature for incorporation in biscuits.

Development of biscuits incorporating beans powder

Micro method III of Finney et al (1950) was used with minor modifications for biscuits preparation. The ingredients for biscuits were as follows

Ingredients	Control	Type I	Type II
Refined wheat flour (g)	100	95	90
Beans powder (g)	-	5	10
Sugar (g)	25	25	25
Cumin seeds (g)	1.5	1.5	1.5
Salt (g)	3.5	3.5	3.5
Milk (ml)	40	40	40
Ghee (g)	40	40	40
Ammonium bicarbonate (g)	5	5	5
Sodium bicarbonate (pinch)	1	1	1

Sensory evaluation

Sensory evaluation of developed biscuits was carried out by a panel of semi-trained judges using 9-point Hedonic Rating scale (Ranganna, 1986). On the basis of mean scores of sensory characteristics (9-point hedonic scale),biscuits with five per cent beans powder had higher scores than the biscuits with 10 per cent beans powder. Hence, the biscuits prepared using five per cent beans powder were evaluated for their nutrient composition.

Proximate composition

All the four types of biscuits along with control biscuits were oven dried to a constant weight at 60°C, ground to a fine powder in an electrical grinder and analyzed for various nutrients.

Proximate composition including moisture, crude protein (N × 6.25), crude fat (ether extraction), ash and crude fiber was determined by standard methods (AOAC, 2000).

Dietary fiber

Total, soluble and insoluble dietary fiber constituents were determined by the enzymatic method given by Furda (1981).

Mineral composition

All the samples (acid digested) were analysed for calcium, phosphorus, magnesium, iron, zinc, copper, manganese and potassium through Atomic Absorption Spectrophotometer method suggested by Lindsey and Norwell (1969).

Statistical analysis

Results were expressed as mean ± standard deviations. Suitable standard statistical methods were used for analysis of data (Panse and Sukhatme, 1961). Statistical significance was set at ($p < 0.05$).

RESULTS AND DISCUSSION

Proximate composition

All the four types of biscuits, prepared with beans powder contained significantly ($P < 0.05$) higher protein content than the control biscuits while did not differ significantly among themselves. In earlier studies similar results were reported by Singh (1999), Dahiya (2004), Vandana (2004), Gallegos-Infante (2010) , Priyanka(2013), Khapre *et al*. (2015), Pratyush *et al*. (2015) and Singh *et al*. (2016)in the value added products. Cluster bean biscuit contained the highest amount of crude fiber (1.27%) whereas cowpea bean biscuits (0.87%) had the lowest amount. French bean biscuits (0.93%), cowpea bean biscuits (0.87%) and sem bean biscuits (0.90%) had almost

Table 1: Proximate composition of biscuits containing fresh beans powder (% dry weight basis)

Type of biscuits	Moisture	Crude protein	Fat	Crude fiber	Ash
Control	0.88 ± 0.03	7.58 ± 0.53	23.50 ± 1.53	0.63 ± 0.09	0.61 ± 0.01
Cluster bean	0.89 ± 0.06	9.10 ± 0.35	24.17 ± 0.73	1.27 ± 0.07	0.83 ± 0.02
Cowpea bean	1.00 ± 0.30	10.35 ± 0.15	25.00 ± 0.29	0.87 ± 0.12	0.82 ± 0.02
French bean	1.27 ± 0.07	9.62 ± 0.25	24.50 ± 0.87	0.93 ± 0.14	0.83 ± 0.02
Sem bean	0.98 ± 0.12	10.17 ± 0.83	24.50 ± 1.15	0.90 ± 0.15	0.81 ± 0.01
CD ($P < 0.05$)	NS	1.54	NS	0.38	0.04

Values are mean ± SE of three independent determinations ;Figures in parantheses indicate per cent decrease (-) / or increase (+) over control values.

Table 2: Dietary fiber content of biscuits containing fresh beans powder (% dry weight basis)

Type of biscuits	Total dietary fiber	Insoluble dietary fiber	Soluble dietary fiber
Control	12.02 ± 0.18	8.79 ± 0.03	3.23 ± 0.15
Cluster bean	14.79 ± 0.13	9.97 ± 0.14	4.82 ± 0.27
Cowpea bean	14.16 ± 0.28	9.51 ± 0.08	4.65 ± 0.25
French bean	13.67 ± 0.33	9.36 ± 0.18	4.30 ± 0.27
Sem bean	13.67 ± 0.33	9.10 ± 0.17	4.57 ± 0.26
CD($P < 0.05$)	0.84	0.42	0.78

Values are mean ± SE of three independent determinations ; Figures in parantheses indicate per cent decrease (-) / or increase (+) over control values.

Table 3: Mineral content of biscuits containing fresh beans powder (mg/100g, dry weight basis)

Type of biscuits	Calcium	Phosphorus	Iron	Zinc	Magnesium	Manganese	Potassium
Control	54.90 ± 0.41	276.47 ± 1.37	5.22 ± 0.02	2.71 ± 0.01	73.42 ± 0.56	1.21 ± 0.62	326.36 ± 5.69
Cluster bean	57.78 ± 0.31	310.50 ± 0.37	6.14 ± 0.18	2.94 ± 0.32	78.25 ± 0.56	1.68 ± 0.09	383.59 ± 5.73
Cowpea bean	57.63 ± 0.31	315.19 ± 1.14	6.07 ± 0.06	2.87 ± 0.18	81.16 ± 0.57	1.64 ± 0.06	371.04 ± 1.49
French bean	57.26 ± 0.22	307.50 ± 0.42	5.99 ± 0.08	3.14 ± 0.07	77.47 ± 0.33	1.75 ± 0.13	399.29 ± 6.89
Sem bean	58.50 ± 0.39	318.17 ± 1.10	5.91 ± 0.19	3.04 ± 0.08	77.06 ± 0.08	1.82 ± 0.03	375.94 ± 8.11
CD (P < 0.05)	1.07	3.10	0.40	NS	1.43	0.25	19.20

Values are mean ± SE of three independent determinations; Figures in parantheses indicate per cent decrease (-) / or increase (+) over control values

similar content of crude fiber. Ash content of control biscuits was 0.61 per cent whereas biscuits prepared from green beans powder had significantly increased amount (ranging from 0.81 to 0.83 %) of ash. Similar increasing trend in ash content after addition of beans powder was reported by Rachna (2006), Singh *et al*. (2009) Gallegos-Infante (2010), Priyanka (2013), Pratyush*et al*. (2015) and Singh *et al*. (2016). A non significant (pd"0.05) difference was observed in moisture and fat content of various types of beans powder biscuits.

Dietary fiber

Among the biscuits, cluster bean biscuits contained highest (14.79%) amount of total dietary fiber whereas french bean and sem bean biscuits had similar amount of total dietary fiber (13.67%). All the biscuits prepared using beans powder had significantly ($p < 0.05$) higher total dietary fiber as compared to control biscuits (12.02%). Cluster bean biscuits (9.97%) contained maximum amount of insoluble dietary fiber followed by cowpea bean biscuits (9.51%), french bean biscuits (9.36%) and sem bean biscuits (9.10%). Soluble dietary fiber content of control biscuits was 3.23 per cent whereas in biscuits prepared from fresh beans powder ranged from 3.75 to 4.82 per cent. Almost similar results of total, insoluble and soluble dietary fiber content in products prepared incorporating *Moringaoleifera* pods powder and chickpea pods powder were observed by Rachna (2006) and Priyanka (2013), respectively

Mineral composition

The perusal of data indicated that calcium content of biscuits prepared with fresh beans powder was significantly ($p < 0.05$) higher as compared to control biscuit (54.90 mg/100g). Sem bean biscuits had significantly ($p < 0.05$) higher amount of calcium than cluster bean, cowpea bean and french bean biscuits. Among the four types of supplemented biscuits, sem bean biscuits contained the highest amount of phosphorus (318.17 mg/100g) followed by cowpea bean biscuits (315.19 mf/100g), cluster bean biscuits (310.50 mg/100g) and frenchbean biscuits (307.50 mg/100g). The data presented in Table 3 showed that supplemented biscuits contained significantly ($p < 0.05$) higher amount of iron (ranging from 5.91 to 6.14 mg/100g) as compared to control biscuits (5.22mg/100g). Biscuits prepared using beans powder *i.e*. cluster bean, cowpea bean, french bean and sem bean had 78.25, 81.16, 77.47 and 77.06 mg/100g of magnesium, respectively. The data indicated that incorporation of fresh beans powder to the biscuits brought about a significant improvement in their manganese content. Total potassium content of biscuits prepared from green beans powder ranged from 371.04 to 399.29 mg/100g, while control biscuits had 326.36 mg/100g. The maximum potassium was found in french bean biscuits (399.29mg/100g) followed by cluster bean biscuits (383.59 mg/100g), sem bean biscuits (375.94 mg/100g) and cowpea bean biscuits (371.04 mg /100g). Similar, increasing trend in mineral content was observed by Rachna (2006), Singh *et al*. (2009) and Priyanka (2013) in value added products prepared using *Moringa oleifera* pods, amaranth leaves powderand chickpea pods powder, respectively.

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